

REMARKS

The Office Action dated June 15, 2004 has been received and carefully studied.

The Examiner rejects claims 1, 3-8 17, 19-20 under 35 U.S.C. 112, second paragraph, as being indefinite for various reasons.

By the accompanying amendment, claim 1 has been amended to provide proper antecedent for "said adjusting mark".

With respect to claim 17, by the accompanying amendment the term "the steps of" has been deleted from the claim. With respect to lines 4-5, the claim has been amended to recite forming a conductive pattern using an aligner. The circuit pattern on the photomask is exposed with an aligner and the pattern will be made to a conductive circuit in a subsequent process (such as photo etching, etc.). In the industry, an aligner means the device including alignment structure and exposing structure.

The Examiner states that claim 19 contains information not supported by the specification. This rejection is respectfully traversed.

The step of forming via holes can be conducted before or after exposing the mask pattern on the board. Figures 5 and 6 show only the process forming via holes, and figure 1 shows the exposing process carried out either before or after the via hole forming process.

The Examiner rejects claim 16 under 35 U.S.C. §102(b) as being anticipated by Zachman et al., U.S. Patent No. 5,111,406. The Examiner states that Zachman discloses at column 5, lines 7-10 that an X-ray image of a particular fixture hole and the fiducial pad may be viewed at the image display, which can be a projection screen. The Examiner

also notes that the claims do not specify a visible mark.

By the accompanying amendment, claim 16 has been cancelled.

The Examiner rejects claims 1-3, 9-10, 12, 14, 17 and 20 under 35 U.S.C. §103(a) as being unpatentable over Smith, U.S. Patent No. 3,984,680, in view of Zachman et al. The Examiner states that Smith discloses an alignment method to align one of several masks relative to a substrate by emitting soft x-rays such that the x-rays pass through multiple alignment marks 13 on a mask 22 and also an alignment mark 15 on a substrate 14 and are imaged onto a fluorescence detector 17. The fluorescence detector converts the x-rays into a visible indication that is used to implement the substrate motion system 21. The Examiner admits that Smith does not disclose that a multi-layered circuit board can be produced, but notes that Smith does disclose that soft x-ray lithography is an effective and convenient means of fabricating microelectronic devices. The Examiner cites Zachman et al. for its disclosure of the production of multi-layered circuit boards that include a plurality of insulated layers and a plurality of conductive layers having a conductive pattern. The Examiner concludes that it would have been obvious to combine Smith and Zachman in order to obtain an apparatus for producing a multi-layered circuit board in accordance with these claims.

By the accompanying amendment, claims 1, 9 and 17 have been amended to expressly recite that the apparatus includes an invisible mark that can be imaged by X-rays formed on at least one of the layers of the multi-layered printed circuit board, and a visible adjusting mark formed on the object or photomask.

Smith discloses a soft X-ray mask alignment system that uses board marks and

mask marks to align the board and the mask. However, Smith is otherwise very different from the present invention. X-rays are used to emit the fluorescent X-rays, the intensity of which indicates the proximity of the board marks and the mask marks. Smith does not include a projection screen to convert invisible rays into visible rays (with CCD cameras) so that the alignment of the visible mark and the invisible mark can be conducted using CCD cameras, as now recited in the instant claims. Zachman et al. do not disclose or suggest this deficiency of Smith.

The Examiner rejects claims 4 and 7 under 35 U.S.C. §103(a) as being unpatentable over Smith in view of Zachman et al. and in view of the known background information disclosed by the applicant. The Examiner cites the applicants' statement that the multi-layered printed circuit board has a core board . . . (with) conductive patterns to support the position that it would have been obvious to form X-rays on a core board of the multi-layered printed circuit board.

Claims 4 and 7 are believed to be allowable by virtue of their dependence, for the reasons discussed above.

The Examiner rejects claim 13 under 35 U.S.C. §103(a) as being unpatentable over Smith in view of Zachman et al. and further in view of Tabarelli et al.

Claim 13 is believed to be allowable by virtue of its dependence on claim 9, as amended, for the reasons discussed above. Tabarelli et al. do not supply the deficiencies of Smith and Zachman et al.

The Examiner rejects claim 5 under 35 U.S.C. §103(a) as being unpatentable over Smith in view of Zachman et al., and further in view of Toth et al.

Claim 5 is believed to be allowable by virtue of its dependence on claim 1, as amended, for the reasons discussed above. Toth et al. do not supply the deficiencies of Smith and Zachman et al.

The Examiner rejects claim 8 under 35 U.S.C. §103(a) as being unpatentable over Smith in view of Zachman et al., further in view of Toth et al., and further in view of Koymayama.

Claim 8 is believed to be allowable by virtue of its dependence on claim 1, as amended, for the reasons discussed above. Neither Toth et al. nor Koymayama supply the deficiencies of Smith and Zachman et al..

The Examiner rejects claims 15 under 35 U.S.C. §103(a) as being unpatentable over Zachman et al. in view of Melcher et al., U.S. Patent No. 4,504,727. The Examiner cites Melcher et al. for its disclosure of a method for drilling a hole in a multi-layered circuit board by focusing a laser on the drill point.

By the accompanying amendment, claim 15 has been cancelled.

Applicants note with appreciation the allowability of claims 6 and 11.

The amendment is only now being made in order to expressly recite in the claims the presence of a visible mark.

Reconsideration, entry of the amendment and allowance of all of the claims are respectfully requested in view of the foregoing.

Respectfully submitted,



Kevin S. Lemack

Reg. No. 32,579

176 E. Main Street - Suite 7

Westboro, Massachusetts 01581

TEL: (508) 898-1818